WATER RESOURCES RESEARCH GRANT PROPOSAL

Project ID: 2005AR77B

Title: Flow and hydrochemical evolution of arsenic in ground water: tracking sources and sinks in the alluvial aquifer of southeastern Arkansas, USA

Project Type: Research

Focus Categories: Hydrogeochemistry, Water Quality, Models

Keywords: Arsenic, Alluvial Aquifer, Eastern Arkansas, PHREEQC

Start Date: 03/01/2005

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Federal Funds: $22,925

Non-Federal Matching Funds: $45,850

Congressional District: 3

Principal Investigator:
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Abstract

Chronic exposure to low levels of arsenic can affect the skin, liver, kidney, circulatory systems, gastrointestinal tract, nervous system, and heart with a high risk of cancers of various types (NRC, 1999). Considering the severity of As health effects, the U.S. Environmental Protection Agency has lowered the drinking water maximum contaminant level (MCL) for As from 50µg/L to 10µg/L (USEPA, 2001). According to the Arkansas Department of Health, As concentrations in municipal water supply wells in eastern Arkansas are low. Most municipal water supply wells in eastern Arkansas are completed in the deeper Tertiary aquifers (which is typically low in As) because of the problems associated with Fe and Mn in shallow alluvial aquifers. However, a limited number of water supply wells are completed in the alluvial aquifer and recent publications documenting water quality in the Bayou Bartholomew watershed (Kresse and Fazio, 2002, 2003) revealed that some water wells completed in shallow Quaternary alluvial deposits (alluvial aquifer) with a depth of 80-100 feet had As concentrations exceeding 10µg/L. Domestic wells completed in alluvial aquifers may present risks to private well owners not protected by the Safe Drinking Water Act (SDWA). To assess this risk, a detailed understanding of the occurrence, distribution, and source of As together with its mobilization (release) mechanism and fate in the ground-water environment is essential.

Equilibrium-condition, thermodynamics-based, numerical modeling is currently the most practical way to evaluate the competitive geochemical processes that affect the inorganic transport and toxicity of As (Goldberg, 1998). A modeling approach may provide the only way to make usable predictions regarding arsenic persistence and mobility in the environment (Tessier, et al., 1996). We propose a study of hydrogeology and hydrogeochemistry along the flow paths in three dimensions within the alluvial aquifer of Bayou Bartholomew watershed in southeastern Arkansas. Three wells will be drilled along a flow path in the Bayou Bartholomew alluvial aquifer watershed and detailed ground water and solid phase (mineral assemblages) chemistry will be analyzed. The project will simulate observed As concentrations using the geochemical database that will be generated by PHREEQC (Parkhurst, 1995) geochemical modeling tool.